Figure 5: AVA artist console

amount of system software required. This hardware is represented by the frame store interface block in Figure 3. Some functions performed by this block are:

1. Automatic generating of frame store addresses and direct disk to frame store data transfer without computer intervention.

2. Remembering the edge boundaries of the picture. This task previously required the software to continuously monitor incoming data during picture generation, for frame store locations (addresses) that would fall outside of the established picture boundaries.

3. Presenting the frame store memory to the system software as a two-dimensional computer memory array rather than a special single dimensional organization found in some video frame store memory systems. Thus a point in the memory (picture element) can be specified as a line and column location, rather than a single location plus a continuous offset calculation. This addressing method results in less system software and more flexibility in frame store usage.

Easy maintenance was an important design goal for the system. A special interconnection bus from the graphics hardware to the computer, called the MASTERBUS, is a key system design concept to support comprehensive diagnostic, and hence maintenance, capability. The MASTERBUS, with its associated memory registers,

interfaces the system computer to every sub-unit in the system. These sub-units are easily addressed to facilitate the writing of comprehensive diagnostic software to the circuit board level. The MASTERBUS also interfaces the system clocks to the computer to allow software control for halting, single stepping or free running of the system for troubleshooting.

Adaptability to various television standards was another important design goal. This requires flexibility in both the frame store memory organization and the video processing sections. The frame store is expandable in three directions. Expansion in the horizontal direction allows for changes in sampling rates to accommodate various digital television systems or for increased horizontal resolution. Expansion in the vertical direction allows for changes in line rates such as 525/625 standards. Expansion in memory depth allows frame store additions to support video component (RGB/YUV) systems or additional picture effects.

The necessary control elements to support such memory additions are already designed into the basic system. Additionally, the frame store is designed to have multiple input/output ports (unlike the single input/output stores found in frame synchronizers, for example). This facilitates such future additions as high-speed signal processing hardware to expand the system performance and further relieve the system computer load.

The video output processing circuitry has been designed to change formats through software changes. Thus, such variables as line rates and blanking times that are affected by different television standards, are easily adjusted by the system. This output processing also includes the "reconstruction" filtering for the conversion to analog signals. This filtering is especially important in this application since computer-generated pictures can contain very high frequency artifacts that, if put through television encoders (NTSC, PAL, SECAM) can produce aliasing effects in the encoded pictures.

SUMMARY

The operational and equipment design of the AVA system has focused upon making interactive computer graphics a technology that has practical, operational value in a television broadcast environment. The system design has been dedicated toward a non-technical human interface and operating features that have been defined by working system experience. All interaction with the system is natural and in a conversational dialogue. The design of the operating menus and the associated programs has emphasized practical utility for the artist rather than technical programs for generalized computer graphics applications.

The hardware design has been directed toward easy integration with the specific software tasks needed for

12

graphics operations. This has resulted in smaller computers and minimum peripheral hardware needed to configure a high performance system. Maintenance and reliability considerations were included in the initial system design, taking full advantage of the diagnostic power of the system's computer and hardware designs that can utilize those diagnostics. The technical operation of the system, the video and reference signal formats, and system timing considerations have all been designed to integrate easily into professional television plants rather than for computer or scientific operations.

Both the hardware and software design goals have specified flexibility and modularity to promote the orderly growth of new operating and performance features in the coming years. The software system is highly adaptable and can easily accommodate both hardware and software additions. The system frame store memory and signal formatting sections are easily expanded for more capacity or changed for different signal formats. A modern, interactive computer graphics system should not only add new graphic art capability in present television operations, but should also represent an investment in the future growth of this modern technology.

REFERENCE

1. Regnier, H. K., and Evans, L. J., 1978, "Interactive Computer Graphics in the Broadcast Enviroment," International Broadcasting Convention 1978, Proc. IEE, 166, 238-243.

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B-099

TECHNOLOGY

AMPEX AVA VIDEO ART SYSTEM
JUNAID SHEIKH*

THE AMPEX VIDEO ART system (AVA) is an innovative computer graphics system which allows the artist to create original art in the television medium. AVA offers the artist a wide variety of creative graphic techniques to paint and draw with complete freedom. Artwork can be created rapidly from a broad range of brushes and colours, and then easily altered to meet the dynamic needs of the broadcast industry.

Traditionally, high performance graphic systems have been very large and very expensive. The systems have been experimental in nature and have not provided a practical means of operation for the artist. High reliability and ease of maintenance were not of primary concern, making these systems impractical for use within a broadcast environment. The broadcaster was further hindered by the unfiltered RGB outputs of these systems, which were not suitable for producing a high quality encoded picture.

AVA is the first compact, practical and functional graphics system (shown in fig. 1). AVA was designed to meet the specific needs and requirements of the broadcast industry, thus making it practical to utilise a high performance graphics system as a useful and efficient tool in the production of television graphic art.

AVA provides the broadcaster with a clean, distinctive, crisp on-air look, previously not possible with conventional graphics. This look is achieved through the use of elaborate computer-based hardware and software.

Operation
AVA artist console was designed to provide the artist with a non-technical and natural working environment. This was accomplished through a departure from conventional control mechanisms like switches, knobs, dials, keyboards, etc. Instead, all operations are accomplished through the use of an electronic stylus and data tablet. This presents the artist with the desired natural feel of using a pencil and drawing board. The artist does not require any technical knowledge to operate AVA; in fact he can freely take advantage of his artistic knowledge and skills using the interactive design of the system.

The artist console consists of the data tablet, picture monitor, and menu monitor. The picture monitor displaying the artwork being created is located on the left-hand side, and the menu monitor that presents the artist with all the system operating modes is on the right-hand side. The tablet is electrically divided into two, the left half corresponds to the picture monitor and the right half to the menu monitor. Both displays are fully interactive and provide visual feedback, in real time, of stylus movement on the tablet through the use of cursors. This process of drawing on the tablet and looking at the display for feedback is very natural for the artist.

Presenting large quantities of information in a useful and functional manner has always been a challenge for the equipment designer. The information presented on the menu display is in simple English with emphasis on artistic nomenclature. The approach is one of multi-level menus organized by artistic tasks. The highest level menu, or the main menu, (shown in fig. 2a) contains all the primary operating modes. The left-hand column contains tasks used to create or modify artwork. The right-hand column contains defining, storing and recalling tasks.

When one of the primary modes is selected on the main menu, a secondary or sub-menu appears, presenting the artist with a detailed array of modes corresponding to the selected primary mode. The 'paint' sub-menu is (shown in fig. 2b) a typical example. Exiting a sub-menu takes the artist back to the main menu for further selection of other primary tasks.

This approach of presenting the artist with all the available modes of operation works well because he is not required to memorise commands and enter them into the system. Furthermore, the multi-level menus make it possible to present only the necessary information at any one time without confusing and overwhelming the artist with superfluous information.

Paint mode
Any freehand operation requiring the use of a brush falls within the PAINT mode. In this particular mode, the artist is presented with a wide variety of painting operations to choose from. The artist can freely change brushes at any time selecting from a list of standard brushes or design a special brush to suit his needs. It is important to note that the cursor on the picture monitor does not always appear in one fixed size and shape; in fact, it reflects the true size and shape of the chosen brush. This eliminates any guess work for the artist, since he can see the exact area a brush will cover on the artwork. Colour selection is made by calling up the palette on the picture monitor and choosing the desired colour. The artist is not restricted to selecting a colour from the palette. If the colour desired by the artist appears anywhere on the screen, it can be selected from that point.
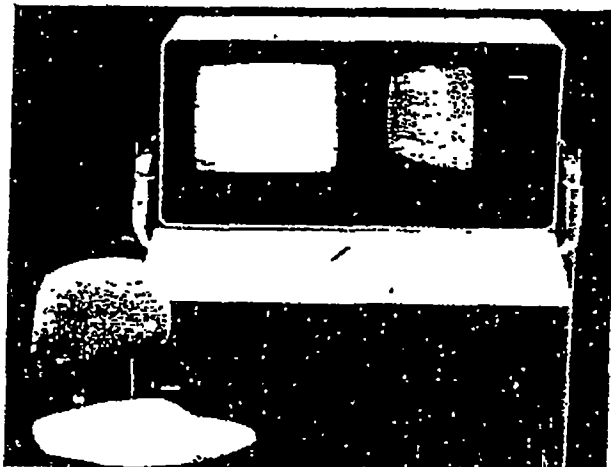
Colour palettes
A palette of 256 colours is available for any picture. The artist has the freedom to design palettes to suit his needs by selecting from more than 16 million available colours. The desired colours are obtained by mixing different amounts of the three primary colours, red, green and blue. This is a very natural operation for an artist since it is just like mixing red, green and blue paints to create the desired colours. After a palette is designed, it can be stored and recalled for later use.

Draw mode
The ability to draw smooth pencil or ink lines is provided in the DRAW mode. The artist has full control over the pencil thickness or line width which can be changed instantly.
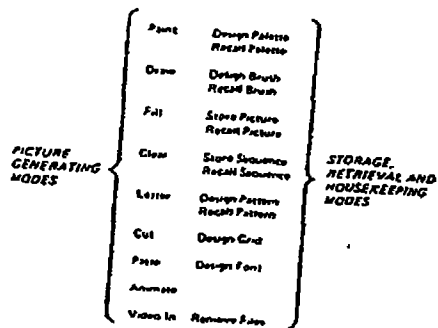
Although freehand painting and drawing give the artist complete freedom in creating renderings, the drawing of geometric shapes and straight lines is not possible without the aid of templates or straight edges. In the preparation of graphic art, certain basic geometric shapes are frequently used. AVA provides the artist with such basic shapes as rectangles, circles, ellipses and straight lines in both the line drawing and solid area painting modes. This system provides the artist with the ability to quickly and efficiently prepare graphics, relieving him of tedious and time consuming tasks.
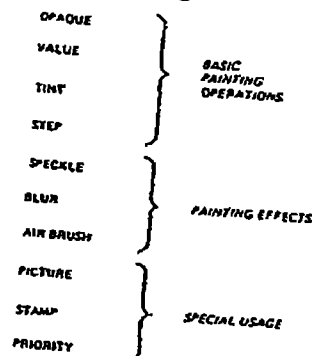
FIG. 1

TECHNOLOGY

FIG 2. (a)AVA MAIN SYSTEM MENU

(b)PAINT SUB-MENU

PICTURE GENERATING MODES
Paint	Design Palette
Paint	Recall Palette
Draw	Design Brush
Draw	Recall Brush
Fill	Store Picture
Fill	Recall Picture
Clear	Store Sequence
Clear	Recall Sequence
Letter	Design Pattern
Letter	Recall Pattern
Cut	Design Grid
Paste	Design Font
Animate	
Video In	Remove Item

STORAGE, RETRIEVAL AND HOUSEKEEPING MODES

OPAQUE
VALUE
TINT
STEP
} BASIC PAINTING OPERATIONS

SPECKLE
BLUR
AIR BRUSH
} PAINTING EFFECTS

PICTURE
STAMP
PRIORITY
} SPECIAL USAGE

Fill mode
Using conventional techniques, the colouring in of outlined drawings is a time consuming and tedious task. This operation is very simple to accomplish in the FILL mode. The artist simply chooses the preferred colour, points anywhere inside the desired area to be coloured, and AVA automatically fills in the colour. AVA allows the artist to fill any general or specific area of one colour with another.
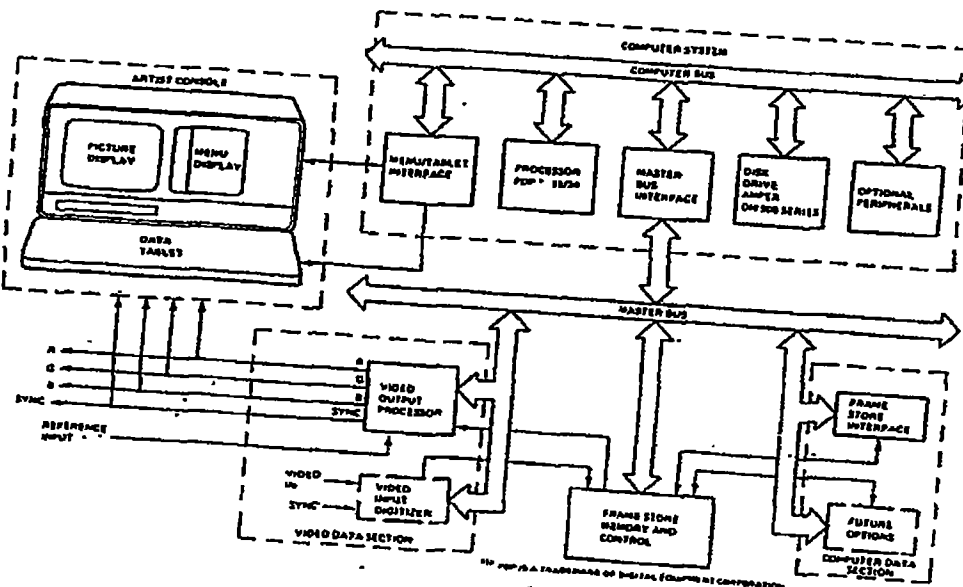
Video scan-in
In addition to generating original artwork on the system, external artwork can be scanned in using a black and white video camera. Operations such as 'reduce flicker', 'sharpen' or 'solarize' can be performed on a scanned-in picture. Once the picture or artwork has been scanned

FIG. 3

32 ►

FIG 4. AVA BLOCK DIAGRAM

31

B-101

TECHNOLOGY

into the system, it can be altered, coloured or embellished using all of the available operations of the *AVA*.

Cut and paste

AVA's ability to do a 'cut and paste' operation arms the artist with a very powerful and functional tool. Valuable time can be saved by using previously completed artwork to compose a new composite paste-up graphic. Any graphic or portion of the artwork can be cut out, rotated, enlarged, reduced and pasted on background artwork. Fig. 3 was created by first scanning in the figure which appear in the foreground. The artwork was then coloured, reduced in size and multiplied several times to create the background. Once the desired background was completed, the full size figure was recalled and placed in the foreground.

Lettering

One of the key elements in television graphics is the presence of text (fonts). The majority of graphics seen on the air use alphanumeric lettering in one form or another to augment the artwork. *AVA* provides this capability in the 'letter' mode. To reduce the flicker generally associated with electronically generated characters, the edges of the letters are blended into the background. This produces high quality lettering. Additional fonts of varied styles and sizes can be added to meet specific needs of the graphic artist.

Picture storage

The ability to store and recall pictures is of primary importance to the graphic artist. Generic artwork can be recalled and quickly altered to create the desired, finished graphic. *AVA* can store hundreds of pictures along with brushes, palettes, etc. Items stored are assigned names in simple English rather than special code numbers to give the artist an efficient and orderly filing system. Since pictures are stored digitally, they can be recalled repeatedly without any loss of quality.

In addition to storing still pictures, art work can be stored in the exact sequence it was created. Upon recall, the picture is recreated, stroke by stroke and colour by colour. This pseudo-animation capability can be effectively used on the air to show charts and bar graphs being developed.

Technical description

AVA has two major components — the artist console and the single electronic rack which houses the computer-based hardware.

The artist console contains a high resolution 48cm RGB television monitor, a data display monitor with interface electronics and an electronic data tablet with stylus and digitizer electronics.

The design objective was to develop a functional package to provide the artist with a comfortable non-technical working environment. The console height, the monitor and tablet angles are adjustable to provide the comforts of a drawing table. The console belongs in an artistic environment because of its aesthetic look and the absence of any technical control mechanism.

The electronic rack contains a Digital Equipment Corporation *PDP 11/34* computer, an Ampex *DM980* computer disk drive, an *AVA* electronics chassis containing printed circuit boards, and power supplies. Fig. 4 is a block diagram of the system.

The *PDP 11/34* is a general purpose computer. The computer has 128k words of MOS memory, a disk drive controller, menu/tablet interface and an interface to the graphics hardware. Space for additional peripherals such as a maintenance terminal and magnetic tape drive controller is also provided.

The Ampex *DM980* is a 80 megabyte disk drive with a five platter removable disk pack. The disk drive provides storage for the operating system, graphics software, pictures, brushes, sequences, palettes, etc.

Flexibility in the design of the frame store and video processing sub-systems makes it possible to adapt to the various television standards. The frame store is expandable in the horizontal direction to meet sampling rate requirements for various digital television systems or higher resolution. Different line rate standards (525/625) are accommodated by expansion in the vertical direction. Changes in the video processing sub-systems to support these various standards are accomplished through software changes.

The video timing generator is programmable which makes timing variables such as line rate, blanking width, horizontal phase, etc., easily adjustable. The video output processor performs the essential task of filtering the video signal after it has been converted to the analog domain. Computer generated video tends to have high frequency artifacts which can cause aliasing in encoded pictures if not suppressed.

The frame store is a multi-port, random access device. In addition to ports dedicated to video input and output processors and the CPU, ports are available for future expansion. The frame store, via the CPU/frame store interface, presents itself to the CPU as a two-dimensional array of memory. Any picture element (pixel) can be accessed by specifying a row (line) number and a column (pixel) number. The two dimensional organization relieves the software of performing unnecessary computations while promoting flexibility, speed and ease of programming. By comparison, the software of a linear (one dimensional) memory organization continuously calculates and adds an offset to the base address.

Unique features of the CPU/frame store interface that further relieve the system computer and software load while boosting the system performance include:

• The automatic incrementing/decrementing of frame store addresses

34 ►

Typical *AVA* graphics
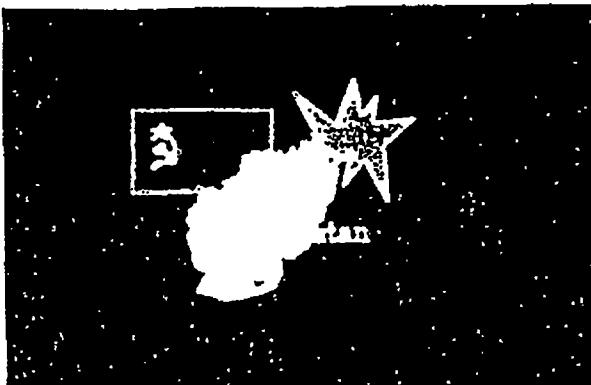
NEWS

VIDEO RIGHTS TALK-IN

THE SECOND International Video Rights Conference staged recently in London by Nord-Media proved something of a disappointment with only 75 or so delegates participating. The subject of video copyright, while important, hardly justifies an annual event with fees at £200 plus for a 1½ day conference.

The main conclusion of the conference was that there is still no general agreement on the legal complexities of video copyright. Film producers are still strongly resisting claims by actors, writers and technicians for extra payments — "residuals" — for material marketed on videograms. And video piracy is still widespread.

Peter Funk of IVS reckoned that there were now over 700 illegal 'ate companies operating in the Middle East. His four-point plan for countering piracy was: the simultaneous worldwide release of home video product: high technical standards and low retail prices: that the continuing debate by distributors of whether to rent or not was a dead issue and should be halted: and that unique productions for the videogram should be encouraged.

Martin Roberts, US professor of film and television at the University of Southern California, gave a detailed description of the extended autumn strike by US actors which revolved around the payment of residuals for video released material. He concluded that, because the home video market is still relatively small, the unions would have been well advised to postpone their showdown for another three or four tars. The actors had gained approximately 4.5% of gross dis-

CCTV AIDS RADIOTHERAPY

RADIOTHERAPY TREATMENT at Belvidere Hospital, Glasgow, is now being monitored by monochrome CCTV. Supplied by Pye Business Communications of Cambridge, the Philips system helps radiographers to ensure that patients remain in the correct position during treatment. It replaces the usual method of viewing the patient and the equipment through a lead-plated glass window. The CCTV system, costing £9,000, comprises three Philips Video J5/20 cameras, each fitted with a zoom lens. This allows close-up monitoring of the instruments and dials as well as the patient. One of the cameras also has a pan and tilt facility. All the cameras are wall mounted though, for special cases, they can be fitted to a tripod. Treatment is viewed on three 30cm monitors which can each receive pictures from two cameras. The system is controlled from a free standing unit situated in an adjacent room.

Pye Business Communications, Cromwell Road, Cambridge

Trilion unit in Liverpool for BL (see Around the Studios).

Mike Wolfe of the BBC's Studio Capital Project Department sitting at the controls of the Thornlite 500 desk in BBC Studio 8.

tributed revenues of new media outlets.

Hugh Laddie, a British barrister, recommended swift legal action against UK pirates using *ex-parte* injunctions and special search and seize orders, which — against popular belief — could be obtained quickly from courts.

Several tedious speakers lectured a bored audience on the attitudes of the EEC to videogram distribution and Unesco's ideas on preservation of films and video tapes. The newly formed British Videogram Association was given several plugs. Speakers were generally in favour of substantial levies to be placed on the retail price of blank audio and video tapes.

Graham Wade
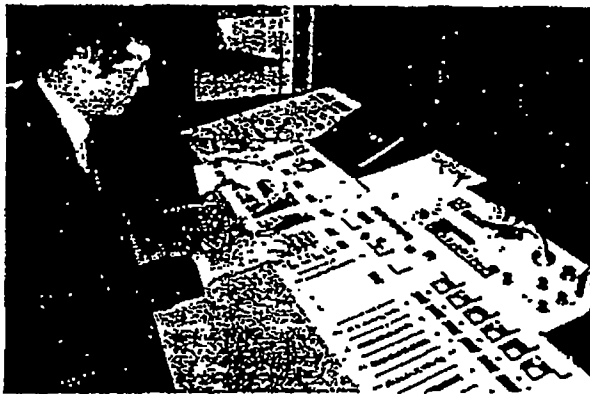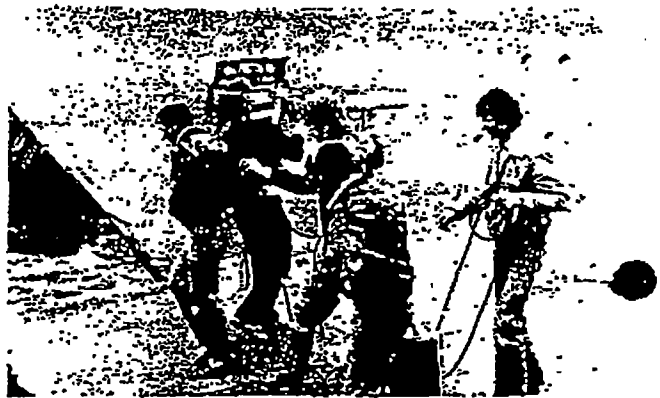
Technology

nates the need for software to present a new address for every access.
● Continuous monitoring of incoming frame store address in order to clip (discard) addresses that fall outside the boundaries of the frame store. Traditionally, system software has been responsible for this task.
● Direct data transfers between frame store and computer disk drive without any intervention from the CPU. This feature facilitates fast picture storage and recall.

Every sub-system in the graphics hardware is interfaced to the system computer through a special interconnection, the master bus. From a systems design point of view, special attention was given to providing master bus access to every func-

tional unit in all the sub-systems. This allows for easy troubleshooting and maintenance through the use of powerful diagnostic routines.

The system software is implemented in a high level language called C, which is supported by a Western Electric operating system, *Unix*.

The single electronics chassis contains high-density printed circuit boards to make up the following sub-systems:

Frame Store Frame storage memory system and associated controls to accommodate various digital sampling rates and scan line standards.

Video Output Processor This subsystem tranforms frame store data into a television raster scan format. Its output is properly filtered analogue RGB timed to internal or external reference.

Video Input Processor This optional sub-system makes it possible to accept external sources of black and white video pictures. The analogue video pictures are filtered, digitized, buffered and formatted for use by the system frame store.

CPR/Frame Store Interface This subsystem provides efficient communication between the computer and its peripherals and the frame store.

Summary

AVA makes interactive computer graphics technology practical and functional for the television broadcast industry. Operationally, the design provides the artist with a natural interface, while software programmes were developed to give him specific modes of operation to enhance the production of television graphics. The system hardware and software design focuses on the flexibility and ease of expansion to meet the growing needs of a dynamic industry. ∎

34

MCI/QUANTEL

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NEWS

March 16, 1981   *DAVE DEVER*

(203) 348-4104

PRELIMINARY DESCRIPTION

The DLS 6000 Series Digital Library System

Summary

The Quantel DLS 6000 Series includes three NTSC broadcast systems that permit recording of still pictures in digital form on standard computer industry disc drives. The DLS 6010 is a basic still-store system. The DLS 6020 includes on-air transition capabilities. The DLS 6030 includes production effects capabilities. Both the 6010 and 6020 are upgradeable to full 6030 capability at any time.

Common to all three units are:

* Compact – basic electronics occupy only 10½" of rack space
* Modular and expandable
* Small, reliable Winchester-type disc drives
* Standard SMD disc drive interface
* Up to 800 pictures per disc drive
* Up to eight disc drives per system
* Versatile control panel operation
* Multi-station control capability
* Economical digital videotape backup system (optional)

System Highlights

DLS 6010 BASIC STILL-STORE SYSTEM

* Asynchronous picture freeze
* Field/frame record
* Picture grab
* Picture erase
* Picture protect

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System Highlights (continued)

DLS 6020 ON-AIR TRANSITION SYSTEM

Includes all the features of the DLS 6010 plus:

* Three independent video outputs (preview and two program)
* On-air picture change
* On-air transitions (cuts, dissolves, wipes)
* On-air editing
* External key recording for captions

DLS 6030 PRODUCTION EFFECTS SYSTEM

Includes all the features of the DLS 6020 plus:

* Picture reposition
* Picture compression
* Picture cropping
* Variable picture aspect ratio
* Multiple picture build-up (montages)
* Border/matte generation
* Titling call-up
* "BROWSE" picture search

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THE DLS 6000 SERIES DIGITAL LIBRARY SYSTEM

Introduction

The revolutionary Quantel DLS 6000 Series Digital Library System represents a new generation of still-store devices that use a computer disc rather than 35 mm slides for picture storage.

One of the many advantages of the system architecture is complete modularity. The smallest unit in the series, the DLS 6010, can be upgraded at any time to 6020 or 6030 status. Similarly, the intermediate DLS 6020 can be upgraded to 6030 status. This continues the Quantel tradition of system modularity, allowing the addition of capabilities as requirements change or budget considerations permit.

The modular architecture will also allow DLS 6000 users to take advantage of the latest advances in Winchester-type disc technology. Although selected disc drives are being offered initially, the incorporation of a standard computer industry SMD (Storage Module Drive) interface means that any drives developed in the future with this interface can be used with any DLS 6000 Series system.

Adding further flexibility and economy to the system is a special off-line tape storage system that allows images to be stored on conventional videotape in digital form. With this optional system, data can be interchanged from disc to disc or a large archival library can be kept on videotape.

The Basic Philosophy

The idea of storing TV stills on a computer disc in digital form is not new. Advantages include high integrity of information, very simple generation of stills, ease of program compilation with greater immediacy, lower operating and maintenance costs, and better security.

The philosophy behind the DLS 6000 Series is the marriage of solid-state framestore techniques with standard computer disc technology. Emphasis has been placed on using completely unmodified computer disc systems to lean on the experience gained in the large market base of the computer industry.

The technology chosen for the storage medium is the Winchester-type disc. This sealed device allows very high packing densities (with up to 800 pictures stored on one disc). Yet the disc drive occupies just a few inches of rack space.

The disk operates at relatively low data rates. Thus a basic computer-based still-store system must include the disc itself and a solid-state framestore able to operate at both real time video rates as well as the disc data rate. In spite of the disc data rate being lower than the full video sampling frequency, no inconvenience results since pictures can still be accessed at rates of two per second.

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The basic task of the system is then to record and replay pictures correct-ly on the disc. This requires just a single framestore, as in the DLS 6010. However, considerable improvement in flexibility is possible if more than one framestore is included. Thus the DLS 6020 and 6030 include three.

The usefulness of the system can be further enhanced if, at the same time, the size and position of the replayed picture can be defined in accordance with the requirement of the rest of the production. This is possible with the DLS 6030. Special circuitry in the DLS 6030 also allows this function to be available for multiple images, permitting the production of montages. A multiple border generating facility completes the full production package of the DLS 6030.

Another feature -- optionally available on all DLS 6000 Series units -- is a videotape backup system. This allows pictures to be stored in digital form on a conventional VTR, cassette or reel-to-reel, resulting in great flexibility and simple interchange of information between one installation and another.

The System

Figure 1 is a block diagram of the DLS 6010 Basic Still-Store System.

The recording chain is shown at the top. Input video enters the system and is immediately converted into digital format and passed to a frame-store at full video data rates. The input framestore acts as a freeze frame device and allows the user to select still pictures from the incom-ing live video.

The input section of the machine can operate asynchronously with respect to the output, thus removing the requirement for a synchronizer for the input video.

Once the chosen image has been frozen in the framestore, it is read out at disc data rate via a data processor section to further reduce data rates. It is then passed to the disc formatter for disc format blocking and written onto the disc.

The disc itself is the latest generation Winchester-type sealed unit with high packing density. Two versions are currently available -- one with a capacity of 340 pictures, the other with 800. Read-write heads are of the flying type but the design of the disc eliminates the need to have expensive head retraction mechanisms. The heads actually land on the disc surface when the platter is not in motion. The disc data rate allows a picture to be generated in 500 milliseconds. The package is highly reliable and rugged. Parity check circuitry is included for optimum data integrity.

The system link with the disk is via the industry - standard SMD inter-face. It is anticipated that new disc drives will conform to this stan-dard for some time to come. Thus users of DLS 6000 Series systems will always be able to take advantage of the latest storage technology.

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The replay chain is shown at the bottom of Figure 1. Data from the disc passes through a disc re-formatter to the framestore. It then is transferred at full video rate into a DAC and onto the display via a proc amp.

The tape backing store system is interfaced to the disc before and after the disc formatter and de-formatter. Information on disc has to be prepared and re-blocked by the tape formatter prior to the addition of syncs and burst for feeding to the tape system. It should be remembered that the tape system is perfectly conventional. Any recorder available in the studio or van will suffice.

When receiving information from the tape backing store, information is unpacked in a tape de-formatter before being passed on to the disc.

Figure 2 shows the block diagram of the DLS 6020 On-Air Editing System and the DLS 6030 Production Effects System.

The recording chain is the same as for the DLS 6010, described above.

The replay chain is more complex because of the two additional framestores and program output facilities.

After data from the disc passes through the disc re-formatter, it goes to one of the three framestores available (in the case of the DLS 6030, it first passes through a data processor). If the information is routed via the preview store, no other processing is done other than reading it out of the store at full video rate into a DAC and onto the display via a proc amp. If the data is fed to one of the program stores, then it is subsequently passed to a digital combiner assembly that performs the appropriate wipe, cut, or dissolve functions. The combiner also copes with the addition of borders or the keying of caption information over pictures or colored mattes.

The input framestore and the preview output are one and the same device since at no time is there a requirement for the two to operate simultaneously. For simplicity, this link has not been shown in the diagram. Also not shown is the host minicomputer that controls the entire system and is responsible for all housekeeping tasks, the operation of the control panel and the editing system.

The tape backing store system is exactly the same as for the DLS 6010 described earlier.

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B-108

The DLS 6010 Basic Still-Store

The DLS 6010 comprises just the one framestore shared between the input and output sections of the machine.

The 6010 thus is really a simple freeze picture device with the ability to store the frozen pictures on disc for recall on demand. The best analogy is of a very basic slide scanner augmented with the ability to capture live incoming information.

As with all versions of the 6000 Series, the tape backing store system is available as an optional extra.

Since no size changing mechanisms or on-air program changes are permitted in this configuration, the replay chain is greatly simplified.

Facilities offered by the DLS 6010 are as follows:

Capacity

Dependent on disc used but currently up to 800 pictures on one disc unit (one picture defined as 1 TV field, for storage of TV frames numbers should be halved).

Number of Discs handled

With optional interface cards, the DLS 6010 has built-in capability of handling up to 8 discs at one time. Numbers higher than 8 require a separate interface box.

Change Rate

Pictures can be changed at a rate of two per second with complete random access.

Asynchronous Picture Capture

The input of the DLS 6010 can handle asynchronous information to allow stills to be captured from incoming remotes.

Field/Frame Freeze

Pictures can be recorded in either field or frame resolution. Typically, "stop motion" will always be recorded in field mode while caption information will use the frame mode. In order to make maximum use of the available disc, a field mode picture occupies half the space of its frame mode equivalent. Field mode and frame mode can be intermixed at will on the disc.

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Picture Grab

In normal operation incoming pictures that have been frozen are not put on to disc automatically. The transfer has to be specifically requested by pushing the record button.

An additional mode of operation exists that is more analogous to a 35 mm camera with "auto wind". This mode, "picture grab", allows incoming pictures to be automatically frozen and recorded on a reserved buffer area of the disc until the operation is terminated or the buffer is full. This enables the operator to grab large numbers of live action shots rapidly as the event is happening, then later edit the disc to specifically erase unwanted shots.

Picture Erase

Single pictures may be erased on disc without affecting those stored on adjacent tracks.

Write Protect

The record mechanism is locked out from overwriting tracks already recorded until they have been specifically erased. ERASE is protected by a two button interlock.

In addition an overall "write protect" hardware interlock is fitted to the disc. When activated, this prohibits all recording and erasing processes.

Tape Back-up Store

The tape back-up storage system is available as an optional extra for the 6010.

The DLS 6020 On-Air Editing System

The DLS 6020 offers the full three framestore facilities but stops short of the processing ability of the fully configured DLS 6030.

Thus the 6020 is analogous to a sophisticated slide scanner that contains two slide carriers and permits on-air changes.

The facilities offered by the 6020 are exactly as described earlier for the 6010 but with the following additions:

Multiple Output

Three outputs are available (two program and one preview), all independent of one another so that, if required, transitions can be effected between the two program outputs.

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B-110

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On-Air Picture Change

Although the change rate is limited to two per second, the additional framestore circuitry in the 6020 allows vertical interval switching between pictures. Thus the switch is instantaneous.

On-Air Transitions

A mix/effect bus can be eliminated by utilizing the digital transitions available. Changes between one picture and the next can be by means of a cut, a programmable dissolve, or even a wipe.

On-Air Editing

The on-air display or transition is unaffected by the contents of the preview store. Similarly, the 6020 allows the capture and recording of incoming material during on-air display or transitions. This feature allows the unit to be used to its fullest extent in the news studio.

Captioning

Facilites are provided for recording an external key along with caption information. On command, the 6020 will automatically key the caption over another still.

The DLS 6030 Production Effects System

The DLS 6030 not only represents a sophisticated slide scanner but also combines many features found in a switcher and digital effects unit.

The 6030 includes all the capabilities of the 6010 and 6020 with the following additions:

Picture Reposition

The output picture of the DLS 6030 can be repositioned by the technical director at will.

Picture Compression

The DLS 6030 will reproduce the stored image at any size from normal (full size) down to virtually zero size. This feature, together with the reposition system, allows the director to define the exact size and position of the reproduced still to suit his production without resorting to any other digital effects device.

Picture Cropping

If only a portion of the still requires display, the 6030 allows the stored image to be cropped. Combining this function with those of compression and reposition allows almost unlimited freedom for picture composition.

Variable Aspect Ratio

The aspect ratio of the image can be varied at will from the standard 4 x 3 to any rectangular shape.

Multiple Picture Handling

The DLS 6030 is capable of reproducing as many pictures as are wanted at the same time. This capability is clearly an adjunct to those of compression and repositioning and is used to show at the same time a number of participants in a discussion or event, or even to build up a complete montage of images. The pictures can be re-called from disc one at a time to show the viewer the build up, or simultaneously so that only the finished composite is seen.

The Borders

The DLS 6030 includes its own border generator capable of changes in hue, saturation, luminance, and width. This is applicable to all pictures being shown, although different images can have different border parameters at the same time.

The border generator also includes a background or matte generator, further releasing the switcher for other functions.

Additional Preview Capabilites

Not only does the DLS 6030 have its own preview output which can be operated without affecting the on-air program or transitions, but it allows the varying size or position of images to be chosen by means of cross-wire cursors controlled by joysticks. It also contains a unique feature for fast viewing called "BROWSE".

"BROWSE"

"BROWSE" provides the ability to look through the contents of the disc by displaying 16 images at one time and slowly moving them down the screen. This rolling list of pictures allows easy viewing to find the desired frame, or permits the showing of pre-chosen slides waiting in the "stack" for display on a program.

Digital Re-recording of Composite Pictures

Composite pictures created on the preview monitor can either be stored as control parameters to ensure recall on demand on the program outputs, or they can be re-recorded back onto disc as a complete new picture at an individual location.

L001367

B-112   AX022139

KEY

The DLS 6030 generates an output key that follows the video at all times.

In addition, if an incoming key signal is being used in conjunction with a title for captioning, the size and position change circuits operate on this incoming key signal to allow the stored caption information to be re-sized or positioned if required.

The Control System

In association with the three system configurations are various control panels offering different facilities and varying levels of complexity.

The panels have been designed so that the various sections can be added to one another as the extra facilities are required. Any panel configuration can be used with any hardware configuration. In cases where a panel contains controls for functions not fitted to a machine, those controls will merely become inoperative.

The Replay Only Panel

Figure 3 shows the replay only panel. This is an optional panel for multi-station operation. A picture is accessed by means of punching on the key pad the number of the picture on the disc, then pressing the TAKE button. The temporary register display to the right of the TAKE button will indicate the keys that have been depressed.

Once the picture is taken its title (if this had been recorded earlier) will appear on the top row of the display.

A "stack" of pictures waiting for display can be organized by simply punching the appropriate number and then pressing one of the small round buttons in the column that corresponds to the position required in the stack since it is this column that represents the "stack" with the top "high". The system allows both insert, substitution or assemble editing to take place and the slide number will ripple up the stack as the pictures are taken. In the case of the next slide awaiting display on air, its title will also be displayed.

The Record/Replay Panel

Figure 4 shows the record/replay panel. This is the standard panel that comes with every DLS 6000 series unit. In addition to the controls included on the replay only panel, the record/replay panel includes additional controls for recording and for loading/unloading the videotape back-up system.

B-113

Incoming pictures are frozen via the freeze button and captured in frame
or field mode as selected by the frame button. To record the frozen
picture on disc, the required picture number is keyed in, RECORD is
depressed and the picture number is shown on the register at the top of
the small extra panel. When "TAKE" is pressed at the same time, the
record mechanism is activated.

GRAB operates the special Grab mode, and VIEW will step through all images
grabbed. A picture will be grabbed and recorded automatically each time
the GRAB button is depressed up to a rate of two pictures per second.
Pictures will continue to be grabbed at full speed as long as the GRAB
button is kept pressed.

Pictures can be erased by calling up the number and then pressing simultan-
eously RECORD and CLEAR.

LOAD and DUMP are associated with the tape back-up system. LOAD will
initiate the transfer of information from the back-up tape to the disc
and DUMP will arrange the reverse process from disc to tape. By means
of the key pad the starting and stopping points for the transfer can be
defined. The toggle switches marked Protect and Play/Set-up are associated
with the hard write-protect for the disc and, in the case of the DLS 6010,
whether the store is required to look at incoming video or the disc output.

The Production Effects Panel

Figure 5 shows the record/replay panel augmented with the production
effect controls. This combination of two panels is standard with the
DLS 6020 and 6030. Users of the Quantel DPE 5000 will be familiar with
the concept of the production effects control since they are based on the
pre-select button concept. Buttons A through K are able to store a size
and position of an image. This storing process is accomplished with the
aid of the two joysticks. On the preview display, the cross wires are
positioned by the joysticks to define the position and size wanted; if
"enter" and the required pre-select button is depressed the 6030 will then
memorize those parameters. On replay, while the LED on the button is
illuminated, all pictures will be produced according to the stored
parameters until a different button, or the special case full size loca-
tion, is pressed.

Dissolve times can be set in a similar manner, the number of frames being
typed in from the keyboard. Similarly, cropping is activated by the
cropping button, thus permitting the joysticks to crop rather than re-
size.

Border and matte facilities are also memorized in the preselect locations
with the parameters being controlled by the spring levers below the joy-
sticks.

L001369

The Keyboard

Figure 6 shows the final panel in the control system. This is a typewriter style keyboard used in conjunction with a monochrome TV screen to allow all titling and editing functions. It is standard on the DLS 6030.

Using a powerful conversational language the operator can perform all functions necessary to edit information on the disc, title the picture stored, search for pictures by title alone, sort pictures by title content, dump to and load from the tape back-up store, and prepare stacks and groups of stacks for replay by the replay only or record/replay panels.

The Tape Backing Store

The advantages of Winchester technology disc drive systems are many, not the least of which is the very small physical size and the high reliability possible even in non-clean ambient conditions that would be completely unacceptable for removable disk systems. However, in spite of all the advantages, there is the one apparent disadvantage: transferring pictures from site to site would seem difficult.

This one disadvantage is, in fact, transformed into an advantage with the optional tape backing store. This system allows the contents of the disc, or selected portions to be dumped onto tape, either reel to reel or cassette, then replayed back into a 6000 series unit at either a remote site or at the same site at a later time. In this way, the user is given all the advantages of the conventional slide carrier but with all the added facilities of the electronic system.

In order to maintain high flexibility the information is recorded on the tape in digital format. Thus normal "generation loss" considerations can be forgotten.

However, this technique does not require a "digital VTR": the speeds of transfer are compatible with the disc - not with raw input video. Accordingly, once sync and burst have been added to the purely artificial digital video stream, any conventional analog VTR may be used since the bandwidth of the digital train is well below that of conventional NTSC video.

The technique is not dissimilar to the current use of cassette VTR's for very high quality digital sound. When viewed, the cassette produces a jumble of white and black dots; when decoded by the sound receiving circuits, hi-fi sound results. Similarly with the 6000 series units, if the video on tape is viewed in the conventional manner, it is meaningless, but when played back into the disc and then viewed, perfect video results.

The time to transfer a complete disc full of images ranges from six to sixteen minutes; the smaller the number of images to be transferred the shorter the time. If selecting portions of information from archival tapes, then the fast shuttle of the VTR is the limiting factor. This is considerably faster than physically changing disks.

A normal 1 hour cassette or reel-to-reel tape will hold approximately 3000 pictures so the cassette solution provides a more convenient means of transport than conventional 35 mm slides.

TAPE BACKING
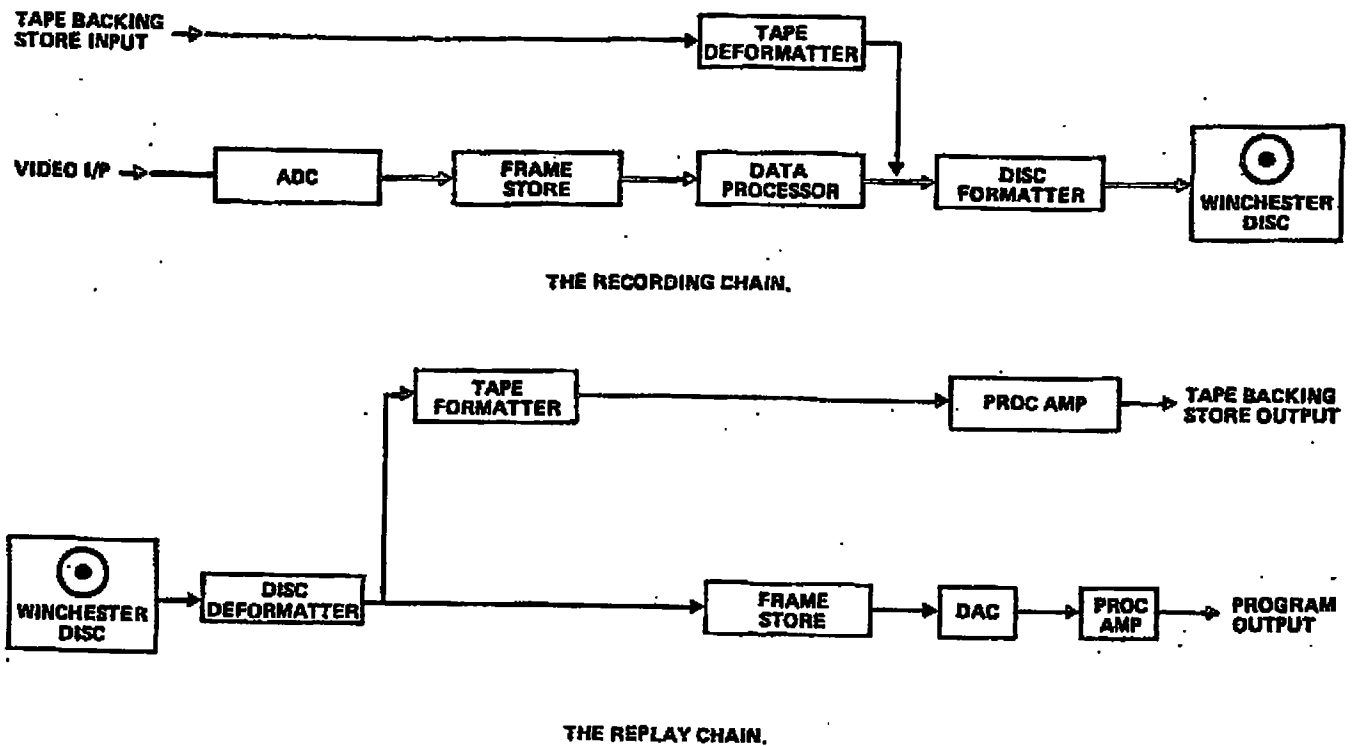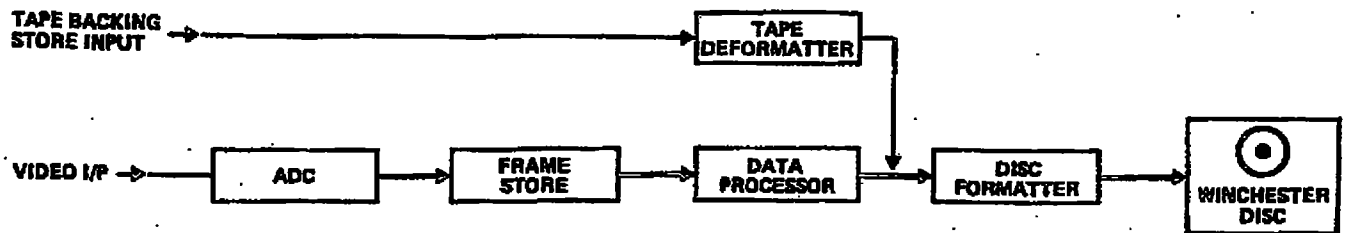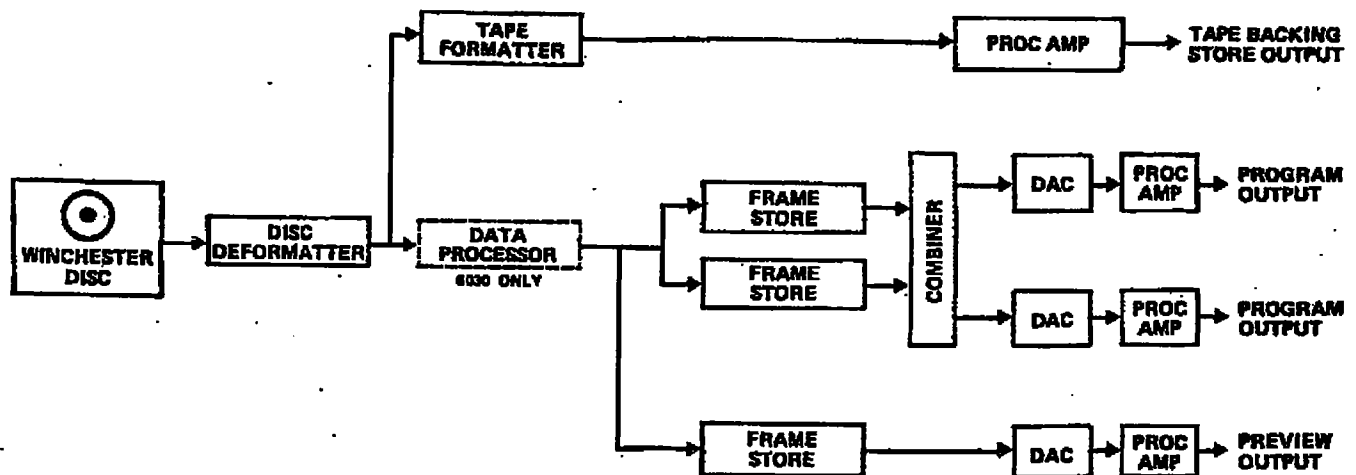STORE INPUT → → TAPE DEFORMATTER

VIDEO I/P → → ADC → FRAME STORE → DATA PROCESSOR → DISC FORMATTER → WINCHESTER DISC

THE RECORDING CHAIN.

WINCHESTER DISC → DISC DEFORMATTER → TAPE FORMATTER → PROC AMP → TAPE BACKING STORE OUTPUT

DISC DEFORMATTER → FRAME STORE → DAC → PROC AMP → PROGRAM OUTPUT

THE REPLAY CHAIN.

FIGURE 1. BLOCK DIAGRAM OF THE DLS 6010

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B-116

THE RECORDING CHAIN.

THE REPLAY CHAIN.

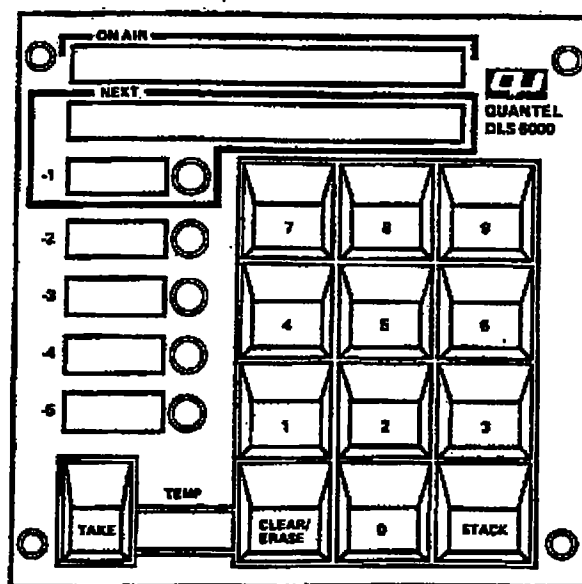FIGURE 2.   BLOCK DIAGRAM OF THE DLS 6020 AND DLS 6030

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B-117
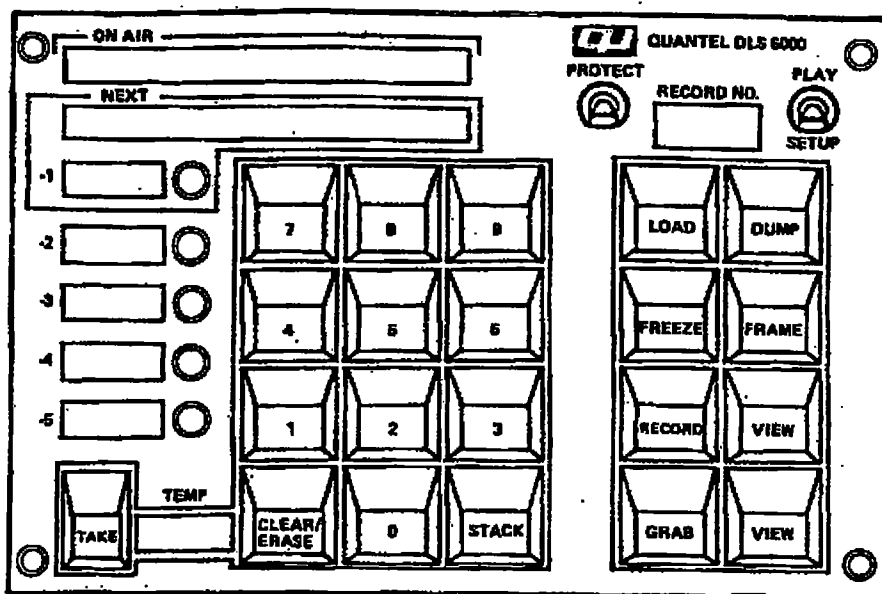
FIGURE 3.   BASIC REPLAY ONLY PANEL

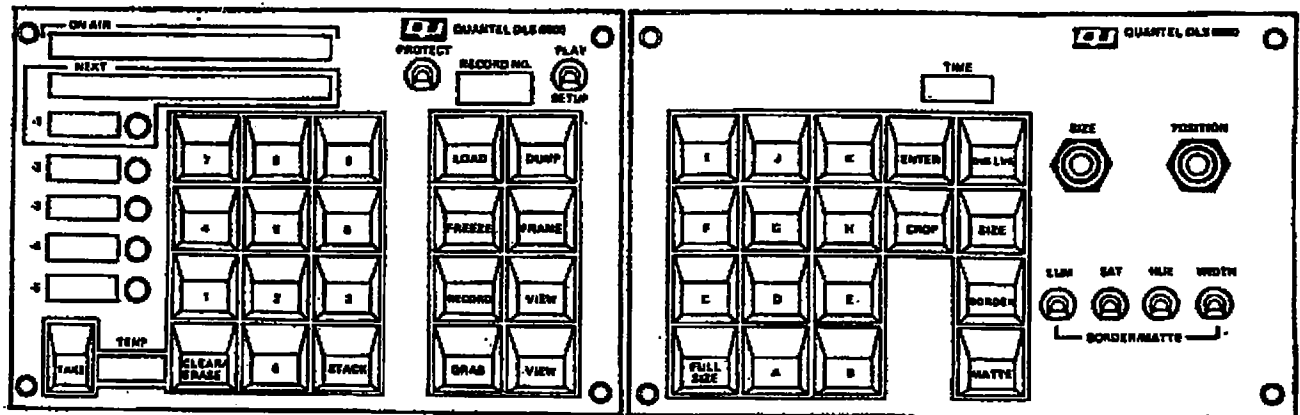L001373

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B-118

FIGURE 4. BASIC RECORD/REPLAY PANEL

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AX022146

B-119

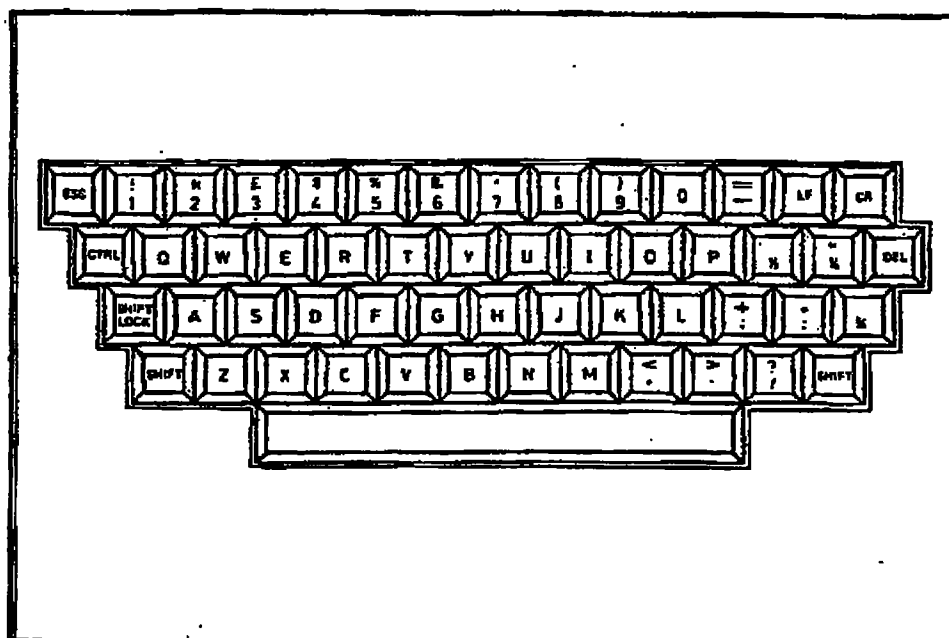**FIGURE 5.   PRODUCTION EFFECTS PANEL**

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B-120

FIGURE 6.   CONTROL KEYBOARD

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B-121

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㊷ System for deleting picture information.

㊼ A system for deleting picture information is provided for a picture information file. The system has a keyboard (3), a 2-dimension scanning device (11), a magnetic tape device (17), a display device (13) and a control device (1) including a microprocessor (31). The deletion of the picture information recorded in the magnetic tape device (17) is performed by recording the delete mark in a delete mark recording area of the retrieval title corresponding to the picture information to be deleted.

EP 0 051 305 A1

B-122

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